THE KOREAN INDUSTRIAL PROPERTY OFFICE

This is to certify that annexed hereto is a true copy from the records of the Korean Industrial Property Office of the following application as filed.

Application Number : Patent Application No. 2003-22999

Date of Application : April 11, 2003

Applicant : Samsung Electronics Co., Ltd.

Dated this: June 17, 2003

COMMISSIONER

PATENT APPLICATION

Applicant : Name: Samsung Electronics Co., Ltd.
(Representative: Jong-Yong YUN)

Address : 416, Maetan-dong, Paldal-gu, Suwon-si, Gyeonggi-do,
Republic of Korea

Agent(s) : Young-Woo PARK

Inventor(s) : Name : Young-Nam YUN

: Address : 304-206 Jugong Apt., Gaepo2-dong,
Gangnam- gu, Seoul, Korea

Inventor(s) : Name : Hyung-Don NA

: Address : #155-1, Sadang3-dong, Dongjak- gu
Seoul, Korea

Title of the Invention : LIQUID CRYSTAL DISPLAY

Dated this: April 11, 2003

To the COMMISSIONER

[ABSTRACT]

[ABSTRACT]

The liquid crystal display device having a mirror function is disclosed. The liquid crystal display device includes an upper substrate, a lower substrate, a first polarizing plate, a second polarizing plate, a third polarizing plate and a liquid crystal layer. The upper substrate includes color filter and black matrix disposed between the color filters, the lower substrate faces the upper substrate, the first polarizing plate is disposed on the upper substrate and selectively reflects light. The second polarizing plate is disposed on the first polarizing plate, and the third polarizing plate is disposed on the lower substrate.

[REPRESENTATIVE FIGURE]

FIG. 1

[SPECIFICATION]

[TITLE OF THE INVENTION]

BACKLIGHT ASSEEMBLY AND LIQUID CRYSTAL DISPLAY

[BRIEF EXPLANATION OF THE DRAWINGS]

FIG. 1 is a schematic cross-sectional view showing a liquid crystal display device according to an exemplary embodiment of the present invention.

FIG. 2 is an exploded schematic cross-sectional view of a liquid crystal display device of showing a path of light, when the liquid crystal display device is used as a mirror.

FIG. 3 is an exploded schematic cross-sectional view of a liquid crystal display device of showing a path of light, when the liquid crystal display device is used as a display device.

<EXPLANATION ON CHIEF REFERENCE NUMERALS OF DRAWINGS >

100 : first polarizing plate	200 : upper substrate
300 : black matrix	400 : liquid crystal layer
420 : overcoat layer	430 : upper ITO
440 : lower ITO	450R, 450G, 450B : color filters
500 : lower substrate	600 : third polarizing plate
700 : second polarizing plate	800 : light source
1000: liquid crystal display device	

[DETAILED DESCRIPTION OF THE INVENTION]

[PROPOSE OF THE INVENTION]

[THE ART TO WHICH THE INVENTION PERTAINS AND THE PRIOR ART]

The present invention relates to a liquid crystal display device, and

more particularly to a liquid crystal display device having a function of a mirror.

A mirror may be attached on personal information device having a liquid crystal display device, such as a mobile phone and a personal digital assistance (PDA).

The mirror may be attached on a flip of the mobile phone or on a backside of a battery of the mobile phone, so that a user does not need a separate mirror. However, the mirror may be broken. Therefore, the personal information devices having a mirror function are required.

The general liquid crystal display device uses a liquid crystal display panel as a mirror in a reflection mode, and as a display panel in a transmissive mode.

However, in a reflection mode, an external light passes through a polarizing plate and enters the liquid crystal display panel to be reflected. Thus, a reflectivity is lowered. When the liquid crystal display panel or a back light assembly is used as a mirror, the reflectivity is lower than 10%, so that an image is not clear.

[TECHNICAL OBJECT OF THE INVENTION]

Accordingly, the present invention is provided to liquid crystal display having a function of a mirror.

[CONTRUCTION AND OPERATION OF THE INVENTION]

A liquid crystal display device according to the present invention includes an upper substrate, a lower substrate, a first polarizing plate, a second polarizing plate, a third polarizing plate and a liquid crystal layer.

The upper substrate includes color filters and a black matrix disposed between color filters. The first polarizing plate is disposed on the upper substrate, the second polarizing plate is disposed on the first polarizing plate to selectively reflect light, and the third polarizing plate is disposed on the lower substrate.

Hereinafter the preferred embodiment of the present invention will be described in detail with reference to the accompanied drawings.

FIG. 1 is a schematic cross-sectional view showing a liquid crystal

display device according to an exemplary embodiment of the present invention.

Referring to FIG. 1, a liquid crystal display device 1000 according to the present invention includes a liquid crystal layer 400, a first polarizing layer 100, a second polarizing layer 700, an upper substrate 200, a lower substrate 500 and a third polarizing layer 600.

An upper ITO layer 430 and a lower ITO layer 440 including indium tin oxide are formed on the upper and lower substrates 200 and the 500, respectively. The first polarizing plate 100 is disposed on the upper substrate 200, and the second polarizing plate 700 is disposed on the first polarizing plate 100. The third polarizing plate 600 is disposed on the lower substrate 500. The liquid crystal display device 1000 further includes a light source 800.

A metal layer having a good optical transmissivity is formed on the upper substrate 200, and the metal layer is patterned to form a black matrix 300. The metal layer may include aluminum (Al), aluminum alloy (Al alloy), chromium (Cr), titanium (Ti) and tantalum (Ta). The black matrix 300 reflects light that passes the upper substrate 200, so that the black matrix 300 enhances a function of mirror.

An aqueous solution including gelatin, casein, etc. is coated on the upper substrate 200 having he black matrix 300 formed thereon, and then red color is dyed to form the red color filter 450R. A green color filter 450G and a blue color filter 450B are formed through a same way.

An over coating layer 420 is formed on the red, green and blue color filters 450R, 450G and 450B through a method described above.

The over coating layer 420 levels a surface defined by the color filters 450R, 450G and 450B and the black matrix 300. The upper ITO 430 is formed on the over coating layer 420, for example a vacuum evaporation method, sputtering method, etc.

The first and second polarizing plates 100 and 700 are disposed on the upper substrate 200.

The second polarizing plate 700 corresponds to a selective reflecting polarizing plate that reflects light by an amount of 50%, and the first polarizing plate 100 corresponds to an analyzer.

The second polarizing plate 700 reflects an external light, so that the liquid crystal display device 100 has a mirror function.

A polarizing axis of the first and second polarizing plates 100 and 700 are substantially same, so that a light reflected from the black matrix 300 may pass the first and second polarizing plates 100 and 700 without being blocked.

The lower substrate 500 includes a lower ITO layer 440, and a third polarizing plate 600 is disposed on the lower substrate 500. A light source 800 is disposed under the lower substrate 500. The third polarizing plate 600 polarizes light generated by the light source 800.

FIG. 2 is an exploded schematic cross-sectional view of a liquid crystal display device of FIG. 1 showing a path of light, when the liquid crystal display device is used as a mirror.

Referring to FIG. 2, when a lamp 110 of a liquid crystal display device 1000 is turned off, the liquid crystal display device 1000 may function as a mirror. An external light is reflected on a second polarizing plate 700, so that the liquid crystal display device 1000 functions as the mirror.

A light is an electromagnetic wave having a specific range of wavelength. When a direction of an oscillation of the electromagnetic wave is isotropic in a direction that is vertical to the advancing direction of the light, the electromagnetic wave is referred to as a natural light. When a direction of an oscillation of the electromagnetic wave is fixed, the electromagnetic wave is referred to as a polarized light. An eye of human cannot identify the natural light or the polarized light. The polarized light can be identified by the polarizing plate.

The liquid crystal display device 1000 includes the second polarizing plate 700, the first polarizing plate 100 and the third polarizing plate 600.

A portion of light that is not reflected by the second polarizing plate 700 but transmitted by the second polarizing plate 700 passes through the upper substrate and reflected by the black matrix 300, because the black matrix 300 includes aluminum (Al), aluminum alloy (Al alloy), chromium (Cr), titanium (Ti) and tantalum (Ta).

FIG. 3 is an exploded schematic cross-sectional view of a liquid crystal

display device of FIG. 1 showing a path of light, when the liquid crystal display device is used as a display device.

Referring to FIG. 3, when a lamp 110 of a liquid crystal display device 1000 is turned on, the liquid crystal display device 1000 displays an image. A light generated from the light source 800 is passes through the third polarizing plate to be polarized, and passes through the lower substrate 500, the liquid crystal layer 400, the color filters 450R, 450G and 450B, the first substrate 200 and the second polarizing plate 700 to display an image.

The first and second polarizing plates 100 and 700 have same polarizing axis.

In other words, a light having a specific polarizing axis can pass both the first and second polarizing plates 100 and 700.

When the first and second polarizing plates 100 and 700 have different polarizing axis, light that passes through the first polarizing plate 100 is blocked by the second polarizing plate 700, so that the liquid crystal display device 1000 display no images.

Therefore, the liquid crystal display device 1000 displays images, regardless of the second polarizing plate 100.

[EFFECT OF THE INVENTION]

The liquid crystal display device includes the second polarizing plate that is attached on the first polarizing plate. Thus, the liquid crystal display device has a mirror function. Furthermore, the black matrix includes metal having good optical reflectivity, so that the mirror function is enhanced.

Hereinbefore, a normally white mode liquid crystal display device is explained for an example. However, the second polarizing plate may be attached on a normally black mode liquid crystal display device. In normally black mode liquid crystal display device, the second polarizing plate, the first polarizing plate, and the third polarizing plate have substantially parallel polarizing axis.

Having described the exemplary embodiments of the present invention and its advantages, it is noted that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of

the invention as defined by appended claims.

[CLAIMS]

[CLAIMS 1]

A liquid crystal display device comprising:

a back light assembly that generates a light;

a liquid crystal display panel including an upper substrate, a lower substrate facing the upper substrate, the liquid crystal display panel displaying an image by using the light generated from the back light assembly;

a first polarizing plate disposed on the upper substrate;

a second polarizing plate disposed on the first polarizing plate, the second polarizing plate selectively reflecting an external light;

a third polarizing plate disposed on the lower substrate; and

a liquid crystal layer interposed between the upper substrate and the lower substrate.

[CLAIMS 2]

The liquid crystal display device of claim 1, wherein the first and third polarizing plate polarizes and transmits the light.

[CLAIMS 3]

The liquid crystal display device of claim 1, wherein the second polarizing plate reflects a portion of the external light, the portion being above 50%.

[CLAIMS 4]

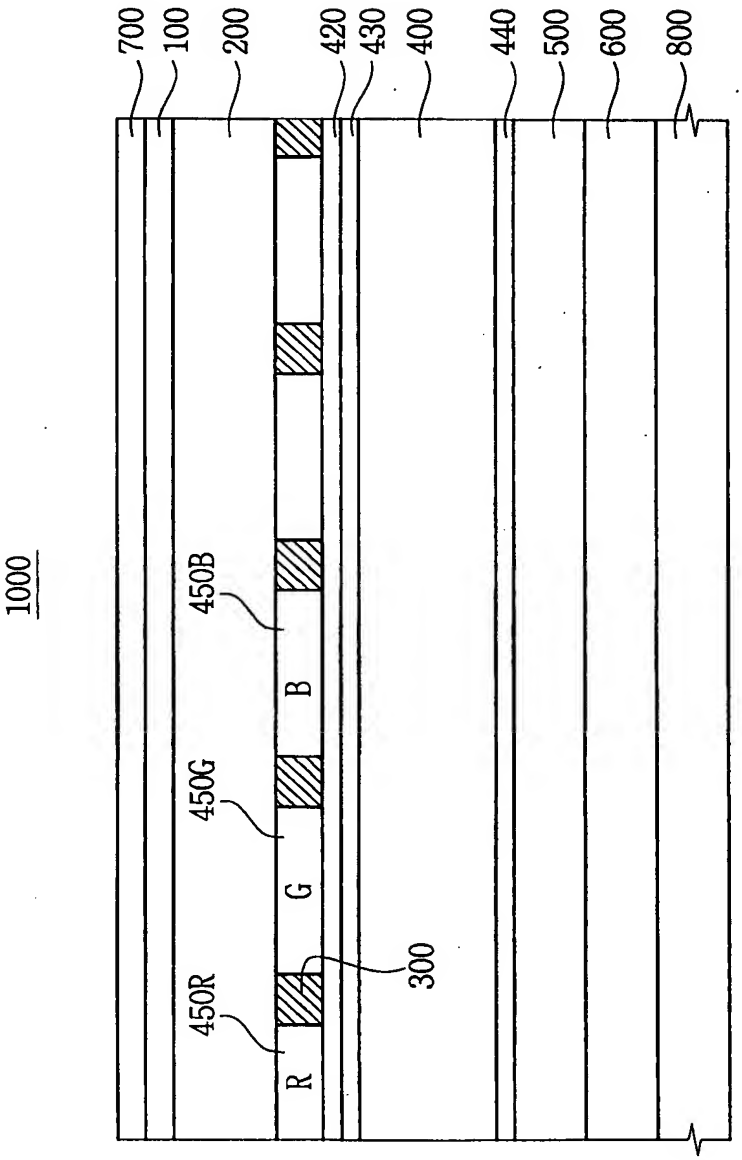
The liquid crystal display device of claim 1, wherein the upper substrate includes color filters and black matrix disposed between the color filters.

[CLAIMS 5]

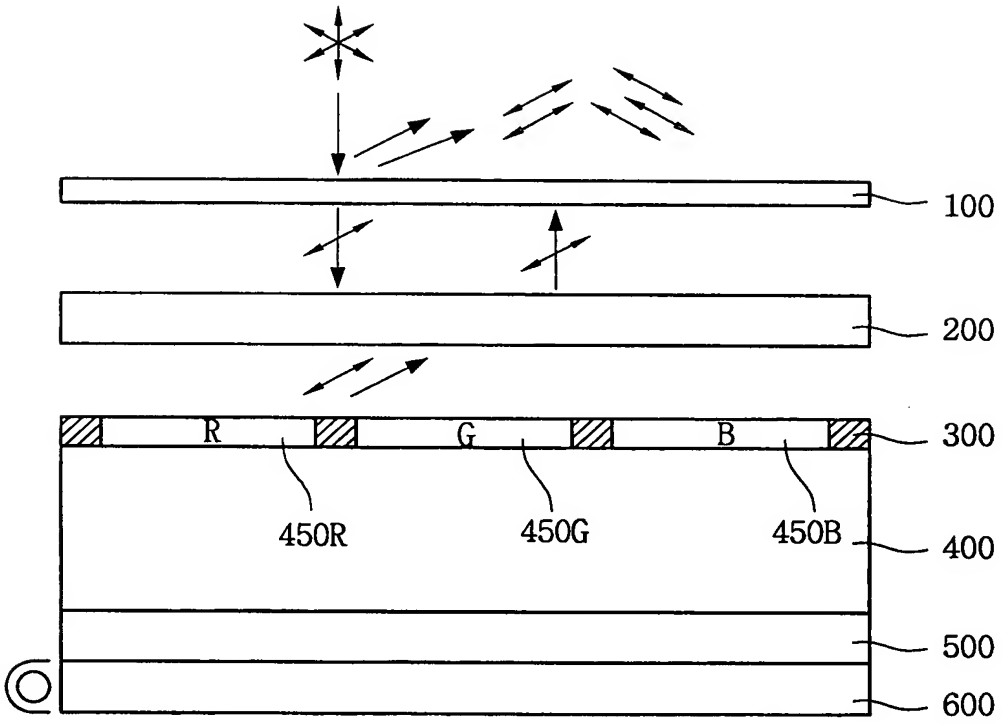
The liquid crystal display device of claim 4, wherein the black matrix comprises one selected from the group consisting of aluminum (Al), aluminum alloy, chromium (Cr), titanium (Ti), tantalum (Ta) and a mixture thereof.

[DRAWING]

[FIG.1]



[FIG.2]



[FIG.3]